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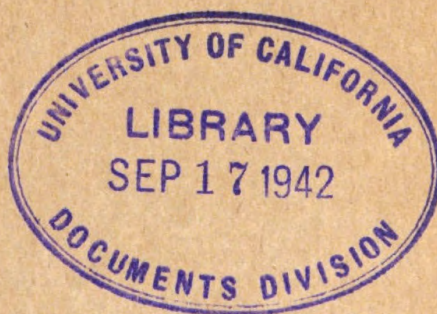
WAR DEPARTMENT

U.S. Dept. of Army

TECHNICAL MANUAL

**CONDUCT OF FIELD ARTILLERY
FIRE USING AIR OBSERVATION**

March 21, 1942



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TECHNICAL MANUAL
No. 6-210

WAR DEPARTMENT,
WASHINGTON, March 21, 1942.

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**CONDUCT OF FIELD ARTILLERY FIRE USING AIR
OBSERVATION**

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SECTION I

GENERAL

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1. **Scope.**—This manual covers the methods and procedure for the control of field artillery fire using air observation.

2. **Air observation.**—To accomplish its mission with effectiveness and speed under conditions of modern warfare, the field artillery, especially long-range artillery, must be furnished with air observation. Air observation permits reports on fire in areas defiladed from ground observers and, under favorable observing

conditions, permits rapid and accurate conduct of fire because the amount of error, as well as its direction, can be sensed.

3. Types of observing aircraft.—*a.* The most important characteristic of the observing aircraft is the ability to remain in position long enough to accomplish its mission.

b. The airplane used for fire control should afford an all-around field of view and permit communication between the pilot and observer without use of interphone.

c. The ability to land in a restricted area is highly desirable; it permits landing in close proximity to the artillery command post, thereby facilitating prearrangement, permitting ready use of short flights at the time desired, and promoting better coordination between the artillery and the observer.

4. Assignments of aircraft.—The number of observation aircraft assigned to the artillery may vary from one per division or groupment to one per battalion. If a single airplane is available to a division or groupment, it is assigned usually to division artillery headquarters or groupment headquarters for control; then, with all battalions listening in on the established radio frequency, any one of them can take up any mission assigned to it.

5. Types of missions.—*a.* There are three types of air observation missions: registration, surveillance of fires, and adjustment on a target.

b. Registration consists of firing on a point or locality to facilitate obtaining data for subsequent fires. After an accurate registration, effective transfers on other targets can be made, within transfer limits. Registration is very rapid when the observer can locate on a photograph the corresponding location, on the ground, of the center of impact of a group of bursts.

c. When precise data have been prepared for a target, the initial fires should be accurate; the observer executes surveillance of the fires by reporting the amount of error, which should be relatively small.

d. When only the approximate location of the target is known, or the preparation of accurate data is impracticable, the observer must adjust the fire.

e. With maps and photographs, surveillance of fires should be the rule; without them, adjustment will be necessary. Even with maps and photographs, adjustment will be necessary until the map or photograph locations of both pieces and target are accurately known to both the observer and the artillery.

f. In general, missions assigned to an air observer should be those which cannot be executed conveniently or accurately from the ground.

When targets are reported by the observer, the decision to deliver fire rests with the artillery commander. Because of possible hostile activity and the probable need for the aircraft on other missions, aircraft must be used at maximum possible efficiency.

6. Types of communication.—The most effective means of communication between airplane and ground is two-way radiotelegraph or radiotelephone. Radiotelegraph produces the stronger signals, has the greater range, and is less subject to interference; radiotelephone is the faster. Communication by air-ground radio and ground-air panels is also effective. With careful prearrangement, communication by two-way radio or by radio and panels may be reduced, and sometimes eliminated. Dropped or picked-up messages are often practicable, especially if they are marked photographs or maps. Visual signals, in general, are slow and impracticable; with prearrangement they may have limited use. The telephone is the means of communication between the captive balloon and the ground; it has the advantage of being free from enemy interception or interference.

7. Target designation.—*a.* It is essential that the same method of designating points and targets be used by both the observer and the artillery. Designation is usually by reference to a grid, when both have the same map or photograph. Without maps or photographs, targets may be designated with reference to points in the target area; these points must be identified from the air by the observer, and they must be plotted on the artillery firing chart in relation to the guns.

b. When such points are not available, the artillery may sight on an airplane as it flies toward or over a target; or a group of rounds may be fired in the middle of the sector and their location corrected by the observer. In either case, after adjustment, this target may be used as a reference point for later fires.

8. Orientation and ground scale.—*a.* When conducting artillery fire, or when reporting a target with reference to some point, the observer must know the approximate direction of the gun-target line, and have some means of measuring distances on the ground. A map or photograph will give him the means of measuring distances; and, if he knows the location of the gun position, he can determine the direction of the gun-target line. Without a map, or not knowing the location of the gun position, he can request LADDER or LADDER SMOKE. (Also, he may request a ladder any time that he has difficulty in locating the fire of the unit.)

b. A ladder (fig. 1) consists of the bursts of three rounds fired rapidly by a single piece (usually the base piece) at a single deflec-

tion setting. The bursts are at intervals of 300 yards in range; the first round is fired at the greatest range. The range of the ladder is the range of the second round. If the observer does not see all three bursts, he should request **REPEAT LADDER**.

c. An approximate ground scale is furnished also by the initial sheaf, which is always computed as 100 yards in width.

9. Air observer.—An air observer must be familiar with artillery organization and technique. While on an artillery mission, he is under the orders of the artillery commander. He must know the tactical situation and be able to analyze the details of the battlefield below him. He must know the established gunnery and communication pro-

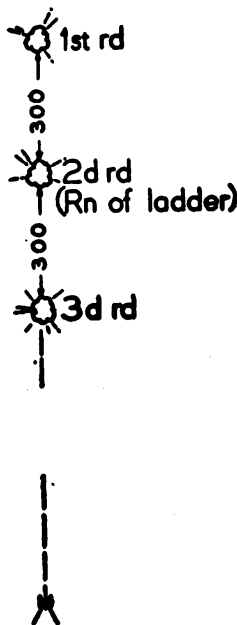


FIGURE 1.—Ladder.

cedure for conducting artillery fire and be familiar with any special details not covered by such procedure. In order to assure a prompt and efficient execution of missions, a conference should be held between the air observer and the artillery for which he is to observe.

10. Prearrangement.—The observer should be given a definite mission before he leaves the ground. It is possible to assign missions to experienced observers in flight, but this requires a great amount of radio traffic and correspondingly makes ground sets more susceptible to interference and to detection by position-finder stations. Routine matters to be prearranged include location of position areas and panel stations; location of target area and front lines; artillery headquarters to which the observer is assigned for control and the number of battalions for which he is to observe; type of com-

munication; call signs and radio frequencies; approximate time of radio check-in; code range, if any; method of point and target designation; locations of known points and targets. While the observer is flying, the artillery must be alert to warn him of the approach of enemy pursuit airplanes.

11. General communication procedure.—The observer, after taking off and approaching the position area, checks in directly with the headquarters to which he is assigned. With normal prearrangement, there is no need for an intermediate check-in with a higher headquarters. Upon completion of a single mission for a subordinate unit, the observer sends: **MISSION ACCOMPLISHED**. The artillery headquarters to which he is assigned then gives him additional missions, or, if missions have been prearranged, the headquarters may send **FOLLOW INSTRUCTIONS**. Upon completion of all missions, the artillery headquarters sends: **NO FURTHER NEED OF YOU, GO HOME**. If the observer is forced down, he sends: **GOING HOME** or **FORCED TO LAND**.

12. Balloon observation.—A balloon observer may conduct fire himself with axial or lateral procedure, or he may act as an air observer. If he acts as an air observer, conduct of fire is similar to that with an airplane observer. The exceptions are as follows:

a. The view of the terrain is more restricted than that from the airplane.

b. Telephone communication is used.

c. The observer may designate targets and report errors either with respect to the balloon-target line or with respect to the gun-target line. The first method is more convenient for the observer, the second for the officer conducting fire. When sensing is with respect to the balloon-target line, the location of the balloon must be plotted on the artillery firing chart; the location of each adjusting round or salvo also must be plotted before the data for the next firing commands can be determined.

SECTION II

REGISTRATION

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13. Types.—Normally, registration is by a precision adjustment on a fixed point or object or by determining the center of impact of

a group of bursts. When air photographs of the target area are available, the center-of-impact method is preferable because it is much quicker and requires little or no communication.

14. Precision adjustment.—*a. General.*—The method of conducting a precision adjustment is given in paragraph 32. Because this type of registration usually consumes a great deal of the observer's time in the air, it should be used only when centers of impact are impracticable, or when previous registration by ground observers is impossible.

b. Prearrangement and procedure.—The observer is shown, on a map or sketch, the locations of the points of registration for each battalion; usually one registration point per battalion is sufficient. The order in which units will register is also given the observer. After taking off and checking in with the artillery command post, he sends, for example, **BATTALION AV3, FIRE**, and proceeds with the adjustment. If the observer has difficulty in locating the initial round, he may request a ladder (par. 8*b*). When maps or photographs are not available, the observer must select a registration point himself. In this case, data for the initial round may be either that determined by lay-on-me methods (par. 24*c*), or that which will place an initial burst (preferably smoke) near the center of the zone of fire.

15. Center of impact.—*a. Procedure.*—Registration may be by one battery per battalion; in some situations each battery of the battalion may register. The registering battery fires a preliminary round (usually smoke) in the area where the center of impact is desired. If the burst falls on or near some terrain feature identifiable on an air photograph, the observer requests additional rounds in the same location by sending **FIRE FOR EFFECT**. Or he may sense the initial burst with respect to a better location and then request the additional rounds, for example, **200 OVER, FIRE FOR EFFECT**. The additional rounds may be fired as a battery volley (converged on No. 1) or as four rounds fired in rapid succession from one gun. In this method of registration the observer pin-points the center of impact of the bursts on a photograph and either reports the photograph location by radio or drops the photograph at the artillery command post. The initial data for registration should be determined by each battalion before the observer arrives, so that no time will be lost in firing the successive groups of bursts.

b. Prearrangement and communication.—The observer is told the order in which the battalions or batteries are to register, and on his

photograph the probable areas of impact should be marked and numbered. Radio communication may be eliminated entirely if the observer identifies himself in some prearranged manner, for example, by circling over the artillery command post. The identification signal also may be made the signal for firing the groups of bursts at specified intervals. However, two-way radio permits the quickest registration; the observer reports the location of one center of impact and immediately calls for the next one. The intervals between the registrations depend upon the ease or difficulty of locating the necessary points on the photograph. The radio transmissions of the ground sets are so few and simple that panels may easily be substituted. When calling for registrations in turn, the observer sends: BATTALION AU3, FIRE; ----- BATTALION PG1, FIRE; ----- etc.

c. Location of areas.—When a gridded photograph is available, the probable areas of impact need not be indicated to the observer before he takes off; they can be designated by photograph coordinates while he is in the air, for example, REPORT CI, PHOTO 36, KM 27.

16. Less precise methods.—*a. Initial target.*—In moving situations, fire may be opened on a target without previous registration; without survey; or before a firing chart has been constructed. In this case, the adjustment upon any target may be considered as a registration and the target used as a reference for designation of other targets.

b. Center of impact without maps and photographs.—When maps or photographs are not available, center-of-impact registrations may still be used. After registration is completed, the observer must remember where the centers of impact were, in order that he can use the centers as reference or check points for later designation of targets. As in paragraph 15a, to facilitate later reference he may move the bursts to a terrain feature.

c. Ladder.—In an extreme case when speed is essential, maps or photographs are not available, ground registrations are impossible, no points in the target area can be designated to the observer, and the observer does not know the locations of the battalion position areas, a ladder (preferably smoke) may be fired by one battalion, or by two or more battalions in turn. This furnishes the observer with a ground scale, shows him the approximate line of fire of each battalion, and, by remembering or recording the location of the center round of each ladder, he has reference points for later designation of targets.

d. Subsequent fires.—After registration by these less precise methods, adjustment rather than surveillance will be the rule. Initial firing data for subsequent targets usually will not be sufficiently accurate for surveillance.

SECTION III

SURVEILLANCE OF FIRES

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17. General.—When precise firing data can be prepared, minor corrections, rather than detailed adjustment, should suffice to place fire on the target. The designation of a target refers to its center. In general, the initial volleys are computed to center the mass of fire on the target; for example, all batteries may fire at the center range and depend upon range dispersion for coverage in depth, or within any one battalion one battery may fire at the center range, one battery at the range 100 yards short of center, and one battery at the range 100 yards over. The observer reports the errors of the individual batteries or battalions, if practicable; otherwise he reports on the mass of the initial volleys as a whole. He makes his report as quickly as possible in order that fire may be corrected promptly. When the fire for effect is completed, or when that part of it is completed for which reports are desired, the observer is notified, **FIRE FOR EFFECT COMPLETED**. All targets or areas must be positively identified by the observer.

18. Types of surveillance missions.—Fires for which surveillance is executed are generally of two types: those on targets designated to the observer before he takes off, and those on targets designated to or located by him after he is in the air. The first type includes missions fired on a time schedule or on call; those on call include requests from the ground and requests from the observer, if he identifies targets in previously designated localities. The second type (fires on targets located after the observer is in the air) may be requested by the artillery commander or by the observer. In either case the location of the target must be given accurately, usually with reference to some form of grid. In the absence of any point-designation system, the observer may drop a marked photograph, map, or sketch at the artillery command post,

and furnish surveillance later. If he can no longer observe because of hostile activity, accurate fires on these targets are still possible provided there has been previous registration.

19. Prearrangement.—The observer may be required to execute surveillance of either or both types of fire described in paragraph 18. For the first type, he must be furnished a marked photograph, map, or sketch, in order that he may positively identify the targets after he is in the air. For the second type, he must be able to report the accurate locations of targets he discovers, and he must be able to determine the accurate locations of targets designated to him from the ground. The observer should know the number of battalions for which he is to observe and the locations of their position areas.

20. Procedure.—*a.* In general, communication procedure is relatively simple and is indicated by the type of mission.

b. For fires on a time schedule, little communication is necessary; the observer simply notes the errors of the initial fire and reports, for example, CONCENTRATION 35, 20 LEFT, 50 OVER. He measures errors as accurately as his ground scale permits.

c. When a target is located in a previously designated area while the observer is in the air, the procedure is as follows:

(1) For fires on call from the ground, the artillery commander sends, for example, CONCENTRATION 76; WILL FIRE FOR EFFECT; the observer acknowledges: WILCO, FIRE; and later reports the errors of the initial fire. It often is desirable to fire short bursts of fire for effect, with intervening time intervals, rather than to fire all the allotted ammunition at once. This procedure facilitates surveillance. Two or three volleys are fired; the observer is notified, FIRE FOR EFFECT SUSPENDED. Sensings are reported and corrections made prior to resumption of fire for effect.

(2) For fires on call from the air observer, the observer may send, for example, CONCENTRATION 52, COUNTERATTACK, FIRE FOR EFFECT. The artillery commander acknowledges: ROGER; and later sends, for example, BATTALION AU3 WILL FIRE. This battalion, listening in, acknowledges receipt (in this example, to the division or groupment). It then, after each battery fires, reports to the observer, for example, BATTERY BAKER FIRED; or, if all batteries fire simultaneously, BATTALION FIRED.

d. When a target not in a previously designated area is located while the observer is in the air, the procedure is the same as in *c* above, except that photograph or map coordinates are used for the initial designation of the target. The identification number of the target is furnished the observer as soon as is practicable.

21. Corrections determined.—The observer's time in the air often is limited. Therefore, the artillery must take full advantage of reported errors so that it can apply corrections for later targets. Reports of errors in fire on more than one target are desirable in order that the artillery may determine whether the errors are persistent in one direction. In this sense, surveillance of fires is also a form of registration (par. 13). When fire on a target must be repeated later, any corrections determined during the interval should be applied.

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ADJUSTMENT OF FIRE

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22. General.—Adjustment consists of correcting the observed positions of the bursts in order to obtain data sufficiently accurate to begin fire for effect on the selected target; the data determined by one battery or battalion may be used by other batteries or battalions. Adjustment missions require the greatest amount of time and air-ground communication.

23. Target designation with maps and photographs.—When maps and photographs are used, adjustment will be necessary until the accurate locations of both guns and targets are known. Photograph or map coordinates are used to designate targets, usually to the nearest one hundred yards. Sometimes the observer may drop a marked photograph or map.

24. Target designation without maps or photographs.—*a. With respect to a line joining position and target areas.*—The observer may designate a target by giving its direction as so many yards right or left of the line running generally through the battalion position area and some known point (base point, check point, or known target) and by giving its distance short of or beyond this point. If this method is to be used for massing the fires of more than one battalion, the locations of both the point and the line must be prearranged and

the fires of the various battalions coordinated through the medium of a common firing chart.

b. Using points of compass.—A target may be designated by giving its direction from a known terrain feature, for example, RAILROAD CROSSING IS 200 EAST, 600 SOUTH, ENEMY BATTERY-----.

c. Lay-on-me method.—When there are no known points for designation of targets, the observer may send, for example, LAY ON ME, ALTITUDE 4000. (If the altitude has been prearranged, it need not be mentioned unless changed.) The artillery commander acknowledges: ROGER, and directs an adjusting battery to follow the airplane with an instrument. The airplane flies along the gun-target line and, when directly over the target, makes an abrupt turn. The initial firing direction for the battery is taken directly from the airplane, using the instrument reading; the initial range is computed from the known altitude of the airplane and the angle of site to it at the time of turning. When the airplane cannot fly over the target area, it may give direction by flying only a part of the way, or by flying straight to the rear. In this case, the observer must give an estimated range; or, if a code range has been prearranged, he may send, for example, 400 MORE.

d. Using group of bursts.—When there are no reference points for target designation, a group of bursts may be fired near the middle of the zone of fire of the artillery unit; the observer senses their location with respect to the target that he has selected. The bursts may be fired by battery, or by a single piece; they may be fired as a ladder (par. 8b).

25. Marking base (check) point.—When the observer cannot identify any of the reference points indicated to him by prearrangement, he may request, for example, MARK BASE POINT. One or more bursts, preferably smoke, are then fired at the base point, with data determined by previous registration or by other accurate means; or a ladder may be fired, with the center burst computed for the base point.

26. Types of adjustment.—There are two types of adjustments: bracket and precision. Bracket adjustment is normal and is used when no type is specified. Precision adjustment may be used for registration (par. 14), or for adjusting weapons of large caliber on important targets; if not prearranged, it may be requested by either the artillery commander or the observer sending PRECISION ADJUSTMENT.

27. Accuracy in bracket adjustment.—Accuracy of initial data helps in identifying the initial salvo and usually results in early fire for effect. When designating a target initially, and when reporting the errors of the adjusting salvos, the observer measures the distance as accurately as his ground scale permits.

28. Preliminary procedure, bracket adjustment.—*a.* The observer may give the location of the target by any of the methods indicated in paragraphs 23 and 24. As in surveillance, the initial designation of the target refers to the center of the target unless prearranged otherwise. The observer may send, for example, **KN38** (photograph coordinates) ----- **WILL ADJUST**; or **BASE POINT IS 150 LEFT, 300 OVER** ----- **WILL ADJUST**. If the last method is used, the base point is considered as the last burst fired, and therefore the initial shifts for deflection and range are applied in exactly the same manner as those correcting the salvos which follow.

b. When the artillery commander receives the observer's designation of the target, he immediately acknowledges: **ROGER**, and then notifies the observer which battalion will fire the mission (unless the observer was originally assigned to a single battalion). This battalion acknowledges to the division or groupment receipt of the assignment, and then sends the observer, for example, **CONCENTRATION 63, BATTALION WILL FIRE, BAKER**. This message indicates that Battery B will adjust and that the other batteries of the battalion will fire for effect, using the adjusted data. The concentration number (63) need not be given the observer until later.

c. When an observer reports a target, it is assumed that he is ready to observe and adjust; except as indicated in *b* above, he will be given only the preliminary warning **BATTERY FIRED**. If, for any reason, he desires to control the time of fire, he may send **AT MY COMMAND**; then after receiving the message **BATTERY READY**, he sends: **FIRE**, at the appropriate time. In order to discontinue **AT MY COMMAND**, the observer adds the command **FIRE** to the sensing of a salvo, for example, **200 RIGHT, 400 OVER, FIRE**. The battery will now fire as rapidly as possible after receiving sensings.

29. Initial data, bracket adjustment.—The deflection is computed to place the mean line of fire through the center of the target. The width of the initial sheaf (distance between flank bursts) is 100 yards. The site is computed or estimated, when possible; otherwise it may be taken as zero. The method of fire during the adjustment is **BATTERY RIGHT**. Smoke shell may be used initially if visibility is poor, data are inaccurate, other artillery is firing in the vicinity of the target, or there is likelihood of the rounds being lost. A ladder may be substituted for the initial salvo if the observer requests it. He sends, for example, -----, **LADDER, WILL ADJUST**.

30. Conduct of bracket adjustment.—*a.* Fire is opened with a salvo, using data prepared by the officer conducting fire. If the observer does not see the bursts, he reports: **LOST**; to increase the

chance of the observer seeing the next salvo, the officer conducting fire should change the range or deflection or use smoke shell. If the observer has reason to believe that the bursts are obscured by some terrain feature, he may sense **LOST, 300 RIGHT, 200 OVER**; or if the observer could not see the target because of a passing cloud or the position of the airplane he senses: **LOST, REPEAT RANGE**. If the bursts can be identified, he senses the burst center with respect to the center of the target and sends, for example, **70 LEFT, 250 SHORT**. If the sheaf is too narrow or too wide for the target, he sends: **SHEAF NARROW** or **SHEAF WIDE**; the battery makes an arbitrary change of deflection difference, usually 5 mils, on an interior piece. The sequence of sensing is the same as that of giving fire commands; no announcement is made of an element that is correct, except that the range sensing is always given. After each of the observer's reports, corrections equal and opposite to the sensings are applied. For example, a salvo is fired at a range of 4,000 yards, and the observer reports: **100 LEFT, 200 OVER**; the deflection is moved right 25 ($100/4$) and the range is decreased 200 yards. The adjustment continues until it is sufficiently accurate for fire for effect.

b. The decision to fire for effect rests with the artillery commander. However, the observer should request it when he considers the adjustment sufficiently close; he may send, for example, **50 SHORT, FIRE FOR EFFECT**. The adjusting battery may fire immediately, or, if other batteries are to come in, it may fire in unison with them. If other battalions are to fire as a result of the adjustment, data must be quickly transmitted to them, and the observer notified, for example, **BATTALIONS AU3 AND PG1 WILL FIRE** (the adjusting battalion is one of those designated). Depending upon the mission and type of target, single batteries may fire when ready, the batteries of each battalion may fire in unison, or all battalions may fire simultaneously. Initial volleys for fire for effect are computed so as to center the mass of fire on the target (see par. 17). The observer senses for each battery or battalion, if practicable; otherwise he senses on the mass of fire as a whole. He should report the errors as quickly as possible in order that corrections may be made promptly. When the fire for effect is completed, or when that part of it is completed for which reports are desired, the observer is notified, **FIRE FOR EFFECT COMPLETED**.

31. Bracket adjustment on auxiliary target.—a. Direct adjustment upon a target may result in loss of surprise before fire for effect is delivered. To prevent this, an adjustment may be made on an auxiliary target whose distance from the actual target is known. This type of mission may be prearranged with the

observer. His initial designation of the target is the same as for other types of adjustment except that the designated location refers to the auxiliary target. He may send, for example, KM 27, ENEMY BATTERY, AUXILIARY TARGET, WILL ADJUST. When the adjustment is completed the observer's request for fire for effect must be preceded by the sensings which will move the fire to the actual target, for example, 300 SHORT, FIRE FOR EFFECT.

b. Preliminary adjustment on an auxiliary target requires correct orientation and an accurate ground scale. Therefore, if during adjustment the observer can measure the errors of a single salvo with respect to the real target, he may consider the location of the salvo as the auxiliary target and request fire for effect at once.

32. Precision fire.—The procedure is similar to that of ground conduct of fire except that range and deflection brackets are not necessary. Adjustment is by single piece. The gunner's quadrant is used. During adjustment, each round is sensed with respect to the adjusting point or the center of the target. As soon as a single burst is sufficiently close to the target so that when a number of rounds are fired there probably will be both shorts and overs, the elevation of the single burst is considered the trial elevation and the message, FIRE 3 ROUNDS is sent by the observer. He senses the deflection error of the half-group and the range error of each round, for example, 20 RIGHT, OVER, SHORT, OVER. Two half-groups are sufficient for registration. The adjusted elevation is computed in the same manner as in axial and lateral conduct of fire.

SECTION V

RADIO PROCEDURE

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33. Scope.—This section covers the radio procedure for the control of field artillery fire using air observation. The procedure for forward ground observers is essentially the same and is also included.

34. General.—The control of artillery fire by radio requires a special procedure designed for brevity, simplicity, and economy of time. Economy of time is particularly essential in the use of air-

plane observation. Careful prearrangement as to the observer's mission and the method of communication may eliminate much of the prescribed routine procedure. Prescribed procedure should be used as a guide for training of observers and operators. However, it is a means and not an end, and it should be altered or omitted when it is apparent that strict adherence thereto is hindering the delivery of fire.

35. Allied procedure.—Operating regulations, station records, and the procedure to be used in establishing communication will be found in FM 24-5 and TM 11-454.

36. Codes.—*a. Fire-Control Code.*—The Fire-Control Code is used by air and ground observers when fire-control messages are transmitted by radiotelegraph; this facilitates communication for observation and conduct of fire. The Fire-Control Code is not used in voice transmissions by either wire or radio; however, for uniformity in training radio operators, the clear text equivalent of the code group, or a close approximation of the equivalent, is used in transmitting fire commands and sensings by radiotelephone. Operators should memorize those code groups most commonly used by their units.

b. Air-Ground Liaison Code.—The Air-Ground Liaison Code is used by the Field Artillery primarily for transmitting tactical information. It may be used for the designation of targets for artillery fire control when appropriate code groups do not exist in the Fire-Control Code. *In no case should groups from both codes be mixed in the same message.*

37. Air-ground net.—*a. General.*—The air-ground net of the division artillery includes the division artillery headquarters station (NCS) and the battalion stations. The net is organized on a given frequency (W) as a directed net when a single airplane is present or expected, or on a schedule prescribed by the division artillery headquarters. At all other times the net is silent.

b. Using one airplane.—Each battalion is assigned a frequency (W, X, Y, Z, or —) to be used when an airplane is to work only with that battalion. If all units are to use one airplane successively, all stations will work on the frequency assigned to the medium battalion, or to a designated medium battalion if there is more than one.

c. Using two or more airplanes.—If more than one airplane is available, each is assigned to a battalion or group of battalions, and a frequency is designated for each airplane. These arrangements are made by the division artillery headquarters prior to the take-off of the airplane. Each airplane then reports directly on the prearranged frequency to the battalion or group station that will control its mis-

sion. It will be most unusual to require an airplane to change frequency while in flight; if a change in frequency is necessary, ground stations change to the frequency of the airplane.

38. Use of conventional call-up.—When the air observer has had little work with a particular artillery unit, considerable use of the conventional call-up (e. g., 4CZ V AP1) may be necessary initially, instead of prefacing a transmission (radiotelegraph) by the break sign \overline{BT} . The break sign may be substituted for the call-up after communication has been established and no interference or difficulty of communication is anticipated.

39. Communication procedure for certain types of missions.—*a.* For center-of-impact registrations and certain types of surveillance missions, transmissions from the ground radio set will be few and simple, such as, REPEAT, BATTERY FIRED, and the acknowledgment, WILCO or ROGER. In such cases, a few simple panel signals may be substituted for the radio. The complete panel station will not be needed; it involves too much personnel and too many panels for the purpose desired. Usually three panels will be sufficient, two of them remaining fixed, while the third one is moved to indicate the desired signal. On other occasions no radio, ground or air, will be needed; the appearance of the airplane may be the signal to fire, and the observer accomplishes his mission by dropping a marked photograph.

b. For other types of surveillance missions and for adjustments (bracket and precision), radio transmissions will be increased. However, most of these transmissions come from the air, and panels may still be used to advantage.

40. Combating interference.—Hostile radio stations can interfere deliberately with radio communication used in the control of artillery fire by blocking a single frequency or a band of frequencies, and by deception; that is, causing our stations to accept false or erroneous information, sensings, and fire commands. The effects of interference can be minimized by—

- a.* Training radio operators to work through interference.
- b.* The strictest observance of radio discipline and radio security.
- c.* Frequent changes of call signs and frequencies.
- d.* Limited use of the conventional call-up.
- e.* Short, quick transmissions.
- f.* Limiting the number of stations in a net.
- g.* Careful prearrangement as to methods to be used, and as to the mission of the observer.
- h.* The use of prearranged signals or groups of letters preceding each transmission to identify the station making the transmission.

If such a method is adopted, each signal or group should be numbered; the sequence should not be repeated; nor should any standardized code or cipher be employed. An arbitrary list of signals or groups of sufficient length for the period of station operation will be found most satisfactory. After the list has been used once, it should be destroyed.

SECTION VI

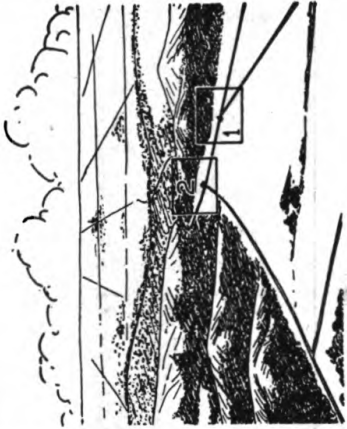
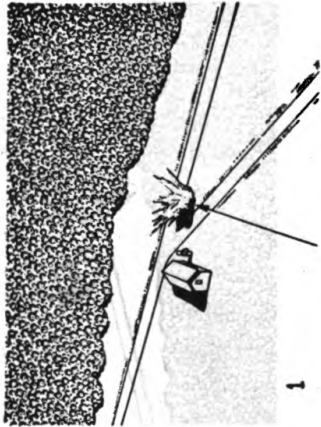
ILLUSTRATIVE EXAMPLES

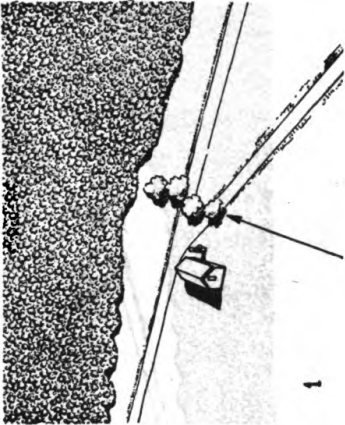
	Paragraph
General.....	41
Examples.....	42

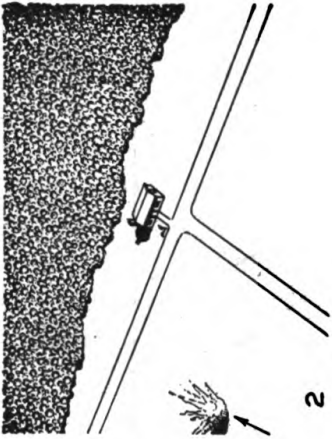
41. General.—In the examples which follow, the air observer is flying over the artillery position area; he has an oblique view of the target area. In the sketches which accompany the examples, the target and bursts are accentuated; nonessential details are subordinated. For clarification, that portion of the sketch in the vicinity of the target has been enlarged.

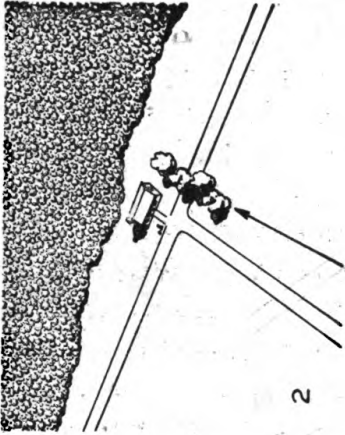
42. Examples.—*a. Example 1.*—(1) *Mission.*—The air observer has the mission of registering, in rapid succession, one battery from each battalion of the division artillery, using centers of impact. The observer is to pin-point the location of each center of impact on an air photograph. After all are pin-pointed, he is to drop the air photograph at the command post of the division artillery.

(2) *Prearrangement.*—The method is explained to the observer. He is given an air photograph of the target area, on which are marked the probable areas of impact. When ready, he is to call for each battery in turn by saying BATTALION AU3, FIRE; ----- BATTALION RM9, FIRE, etc. Each battalion, listening in, directs its registering battery to fire at the proper time. This battery fires one preliminary round, preferably smoke. If the burst is near an identifiable terrain feature, the observer gives the command to fire the group of rounds by sending FIRE FOR EFFECT, which indicates that four rounds (as prearranged in this case) are to be fired. If the location of the preliminary burst is unsatisfactory, the burst is sensed in relation to a satisfactory location, and then the command is given to fire the group. The airplane and all battalions use the same radio frequency. The observer first checks in with the net control station (division artillery) and then proceeds with his mission. The location of the command post where the photograph is to be dropped is indicated to the observer. The center of impact in each case will be that of four bursts fired in rapid succession from the base piece of the registering battery.

Radiotelegraph communication	Radiotelephone communication, sensings, and commands	Results	Remarks
<p>Obsr to Bn: BT 3 AU3 IX 5-sec. dash K</p> <p>Bn AU3 to Obsr: R</p>	<p>Obsr to Bn: BATTALION AU3, FIRE. GO AHEAD.</p> <p>Bn AU3 to Obsr: ROGER.</p> <p>Bn to Btry B: NO 1 ADJ SH SMOKE CH 4, FQ BDL 20 NO 1 ONE RD Q 400.</p>		<p>When practicable the commands may be sent to the battery in advance.</p>
<p>Bn to Obsr: BT 2-sec. dash K</p> <p>Obsr to Bn: R</p> <p>Obsr to Bn: BT FE K</p> <p>Bn to Obsr: R</p>	<p>Bn to Obsr: BATTERY FIRED. GO AHEAD.</p> <p>Obsr to Bn: ROGER.</p> <p>Obsr to Bn: FIRE FOR EFFECT. GO AHEAD.</p> <p>Bn to Obsr: ROGER.</p>		<p>The round of smoke lands in a location near identifiable terrain details.</p>

Radiotelegraph communication	Radiotelephone communication, sensings, and commands	Results	Remarks
<p>Bn to Obsr: <u>BT</u> 2-sec. dash K</p> <p>Obsr to Bn: R</p> <p>Obsr to Bn: <u>BT</u>, RZ K</p> <p>Bn to Obsr: R</p>	<p>Bn to Btry B: SH HE, FQ 4 RDS, 412.</p> <p>Bn to Obsr: BATTERY FIRED. GO AHEAD.</p> <p>Obsr to Bn: ROGER.</p> <p>Obsr to Bn: MISSION ACCOM- PLISHED. GO AHEAD.</p> <p>Bn to Obsr: ROGER.</p>		<p>412 is elevation for HE shell corresponding to 400 for smoke. Observer pricks center of impact of the four bursts on the photograph and marks it "Bn AU3."</p>

<p>Obsr to Bn: <u>BT</u> RM9 <u>IX</u> 5-sec. dash K Bn to Obsr: R</p> <p>Bn to Obsr: <u>BT</u> 2-sec. dash K Obsr to Bn: R</p> <p>Obsr to Bn: <u>BT</u> 100 LL 100 SS FE K Bn to Obsr: R</p>	<p>Obsr to Bn: BATTALION RM9, FIRE. GO AHEAD. Bn to Obsr: ROGER. Bn to Btry B: NO 1 ADJ SH SMOKE CH 4, FQ BDR 40 NO 1 ONE RD Q 370. Bn to Obsr: BATTERY FIRED. GO AHEAD. Obsr to Bn: ROGER. Obsr to Bn: 100 LEFT, 100 SHORT. FIRE FOR EFFECT. GO AHEAD. Bn to Obsr: ROGER.</p>	 <p>2</p>	<p>The round of smoke lands in an unsatisfactory location and is sensed with respect to a clearly defined terrain feature.</p>
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Radiotelegraph communication	Radiotelephone communication, sensings, and command	Results	Remarks
Bn to Btry B: SH HE, CH 4, FQ, R, 20, FOUR RDS, 392. Bn to Obsr: BT 2-sec. dash K Obsr to Bn: R Obsr to Bn: BT RZ K Bn to Obsr: R	Bn to Btry B: SH HE, CH 4, FQ, R, 20, FOUR RDS, 392. Bn to Obsr: BATTERY FIRED. GO AHEAD. Obsr to Bn: ROGER. Obsr to Bn: MISSION ACCOM- PLISHED. GO AHEAD. Bn to Obsr: ROGER.	 2	100/5 = 20 mils. (R = 5) 382 is elevation for HE shell correspond- ing to 370 for smoke. 382 + 10 (1c) = 392. Observer pricks center of impact of the four bursts on the photo- graph and marks it "Bn RM9."

The registration of the remaining battalions continues as indicated for battalions AU3 and RM9, which were two 105-mm howitzer battalions.

NOTE.—In example 1, complete communication procedure has been shown. In the following examples, minor details are omitted. Radiotelegraph communication is shown in its entirety.

b. Example 2.—(1) *Mission.*—The observer has the mission of registering, in rapid succession, one battery from each battalion of the division artillery, using centers of impact. He is to report the location of each center of impact using a target-designation grid.


(2) *Prearrangement.*—Same as for example 1, except:

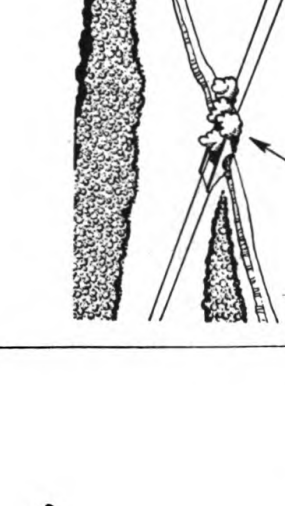
(a) The air photograph furnished the observer has an arbitrary grid on it.

(b) Using photograph coordinates, the location of each center of impact is to be reported by radio immediately after firing. No photographs are to be dropped at the command post.

(c) For each center of impact, the registering battery is to fire a converged volley initially, using HE shell; the volley will be repeated if it must be moved to a better location.

Radiotelegraph communication	Radiotelephone communication, sensings, and commands	Results	Remarks
<p>Obsr to Bn: BT PR5 IX 5-sec. dash K Bn to Obsr: R</p>	<p>Obsr to Bn: BATTALION PR5, FIRE. Bn to Btry B: B ADJ, SH HE, CH 5, FQ, BDL 30, NO 2 R 4, NO 3 R 6, NO 4 R 11 B ONE RD, Q 340.</p>		<p>When practicable the commands may be sent to the battery in advance.</p>
<p>Bn to Obsr: BT 2-sec. dash K Obsr to Bn: BT 50 RR 200 00 FE K Bn to Obsr: R</p>	<p>Bn to Obsr: BATTERY FIRED. Obsr to Bn: 50 RIGHT, 200 OVER, FIRE FOR EFFECT.</p>		<p>The preliminary volley lands in an unsatisfactory location, and is sensed with respect to a clearly defined terrain feature.</p>

<p>Bn to Obsr: BT 2-sec. dash K Obsr to Bn: R</p> <p>Obsr to Bn: BT MP 35 CD DP 4385 RZ K</p> <p>Bn to Obsr: R</p>	<p>Bn to Btry B: L 9, 324. Bn to Obsr: BATTERY FIRED.</p> <p>Obsr to Bn: PHOTO NO 35, DP 4385. MISSION ACCOMPLISHED.</p>		<p>$R=5.7$; $c=8$. $50/5.7=9$ mils. $340-16=324$.</p> <p>Observer pricks center of impact of the four bursts on the photo and measures the coordinates of the point.</p>
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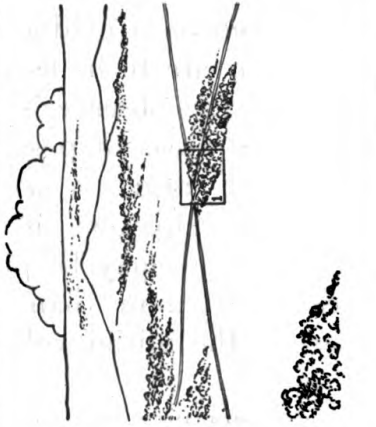
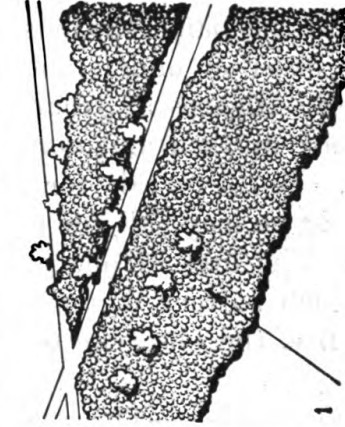
Radiotelegraph communication	Radiotelephone communication, sensings, and command	Results	Remarks
<p>Obsr to Bn: BT 6AO, IX 5-sec. dash K</p> <p>Bn to Obsr: R</p>	<p>Obsr to Bn: BATTALION 6AO, FIRE</p> <p>Bn to Btry B: B ADJ, SH HE, CH 5, FQ, BDL 50, NO 2 R 3, NO 3 R 8, NO 4 R 12, B ONE RD, Q 370.</p> <p>Bn to Obsr: BATTERY FIRED.</p>		<p>The preliminary volley lands in a satisfactory location.</p> <p>Observer pricks center of impact of the four bursts on the photo and measures the coordinates of the point.</p>
<p>Bn to Obsr: 2-sec. dash K</p> <p>Obsr to Bn: R</p>	<p>Obsr to Bn: BT MP 35 CD CO 2469 RZ K</p> <p>Bn to Obsr: R</p>		

The registration then continues, as described for battalions PR5 and 6AO.

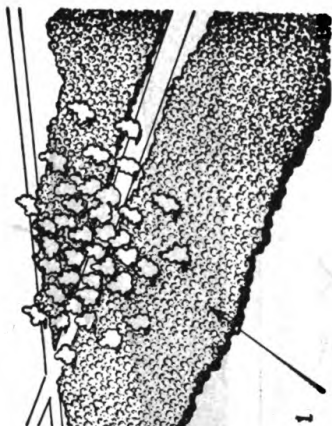
c. Example 3.—(1) Mission.—The air observer has the mission of surveillance of fires for groupment of three battalions of medium artillery. The groupment is part of the division artillery. The observer is to report the errors of the initial volleys as quickly as possible in order that any subsequent fires may be corrected.

(2) Prearrangement.—The observer does not check communication with the division; he reports directly to the groupment. The three battalions use the same radio frequency. The locations of the position areas and the panel stations are indicated on a gridded photograph. The observer understands that panels are to be used in the event of radio silence of ground sets. On the observer's gridded photograph are marked and numbered several areas of possible hostile activity. He is to call for fire upon any targets appearing in these areas, or he may call for fire on targets of his own selection in other areas. The fires of one or more battalions may be placed on any target, each battery firing when ready. If more than one battalion is to fire, the observer is to sense on the initial volleys as a whole.

(3) Communication.—The observer sees activity in one of the previously numbered areas and transmits the following:

Radiotelegraph communication	Radiotelephone communication, sensings, and command	Results	Remarks
<p>Obsr to Gpmt: BT CN 52 CP FE K</p> <p>Gpmt to Obsr: R BT BN DY3 K</p> <p>Bn DY3 to Obsr: BT BA A FE BA B FE BA C FE K</p>	<p>Obsr to Gpmt: CONCENTRATION 52, COMMAND POST. FIRE FOR EFFECT.</p> <p>Bn DY3 to Obsr: BATTERY A FIRING FOR EFFECT. BATTERY B FIRING FOR EFFECT. BATTERY C FIRING FOR EFFECT.</p>		<p>The groupment acknowledges the message, and assigns the target to Battalion DY3. This battalion acknowledges receipt of the message from groupment, giving the observer an opportunity to tune accurately to the battalion's frequency.</p>
<p>Obsr to Bn: BT BA A 30 LL 50 SS BA B CR BA C 50 OO K</p> <p>Bn to Obsr: R</p>	<p>Obsr to Bn: BATTERY A, 30 LEFT, 50 SHORT; BATTERY B, RANGE CORRECT; BATTERY C, 50 OVER.</p>		

The fire of three batteries is massed on target.



Bn to Btries:
(Necessary commands to correct the fire of each battery.)

Bn to Obsr:
FIRE FOR EFFECT
COMPLETED.

Obsr to Bn:
MISSION ACCOMPLISHED.

Gpmt to Obsr:
FOLLOW INSTRUCTIONS.

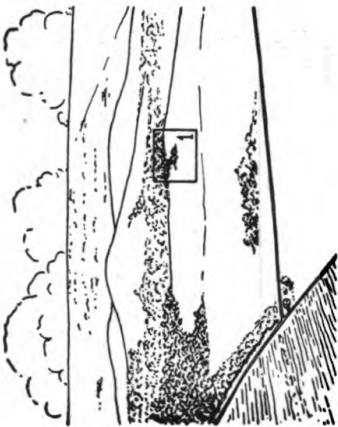
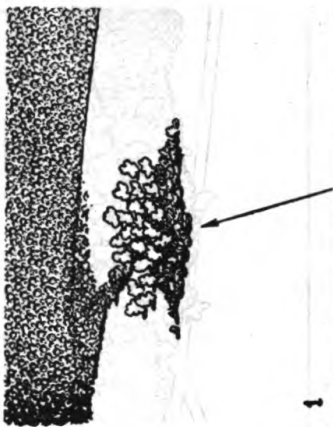
Bn to Obsr:
BT FC K

Obsr to Bn:
BT RZ K

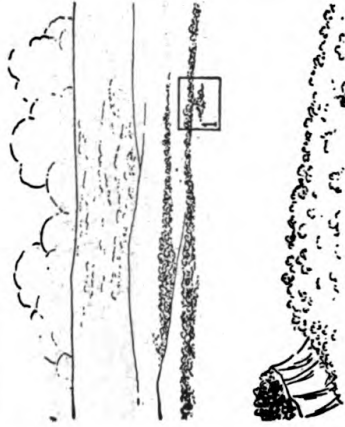
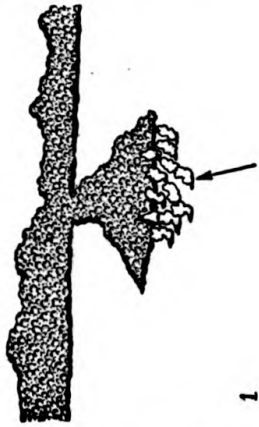
Gpmt to Obsr:
R FI VA

d. Example 4.—(1) *Mission*.—Same as in example 3.

(2) *Prearrangement*.—Same as in example 3, except that all initial volleys, whether by one or more battalions, will be fired simultaneously.

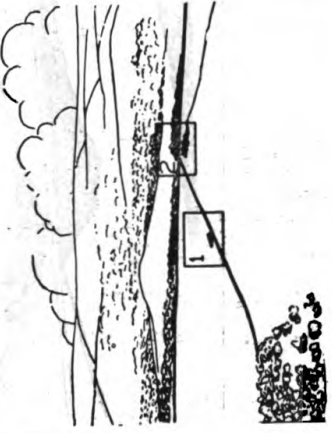
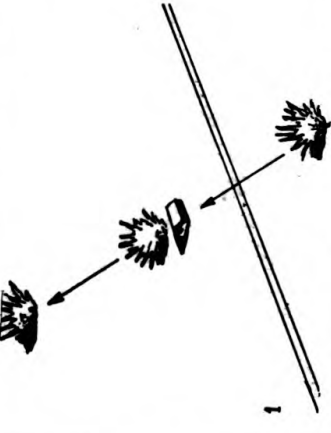
Radiotelegraph communication	Radiotelephone communication, sensings, and commands	Results	Remarks
<p>Obsr to Gpmt: BT CD CY 3462 JA FE K</p> <p>Gpmt to Obsr: BT CN 62 AU3 PG1 K</p> <p>Obsr to Gpmt: R</p> <p>Gpmt to Obsr: BT FE K</p>	<p>Obsr discovers a target and sends to Gpmt: CY 3462, INFANTRY ASSEMBLED. FIRE FOR EFFECT.</p> <p>Gpmt to Obsr: CONCENTRATION 62. BATTALIONS AU3 AND PG1 WILL FIRE.</p> <p>Gpmt to Obsr: BATTALIONS AU3 AND PG1 FIRED.</p>		<p>The groupment acknowledges the message, and assigns the target to Battalions AU3 and PG1. Battalions will fire simultaneously at the command of groupment. The battalions report when they are laid; the groupment gives command FIRE.</p>
<p>Obsr to Gpmt: BT 100 OO GO VA</p>	<p>Obsr to Gpmt: 100 OVER. GOING HOME, FORCED TO LAND.</p>		<p>The observer senses on the mass of the six initial volleys. The battalions listening in correct their fire by reducing the range.</p>



e. Example 5.—(1) *Mission*.—Same as in example 3.
 (2) *P rearrangement*.—Same as example 4.

Radiotelegraph communication	Radiotelephone communication, sensings, and commands	Results	Remarks
<p>Gpmt to Obsr: BT CD DZ 8416 JH CN 68 AU3 FE K</p> <p>Obsr to Gpmt: R OB K</p>	<p>Gpmt to Obsr: DZ 8416, INFANTRY CANNON. CONCEN- TRATION 68. BATTAL- ION AU3 WILL FIRE.</p> <p>Observer acknowledges mes- sage.</p>		<p>Groupment commander receives a request from division commander to place fire on an area from which infantry cannon are firing. Observer identifies area.</p>
<p>Gpmt to Obsr: BT 2-sec. dash K Obsr to Gpmt: R</p> <p>Obsr to Gpmt: BT 50 SS K Gpmt to Obsr: R</p> <p>Obsr to Gpmt: RZ K</p> <p>Gpmt to Obsr: R BT FI VA</p>	<p>Gpmt to Obsr: BATTALION AU3 FIRED.</p> <p>Obsr to Gpmt: 50 SHORT.</p> <p>Obsr to Gpmt after watching remainder of fire: MIS- SION ACCOMPLISHED Gpmt to Obsr: FOLLOW INSTRUCTIONS.</p>		<p>Battalion listening in corrects its fire.</p>

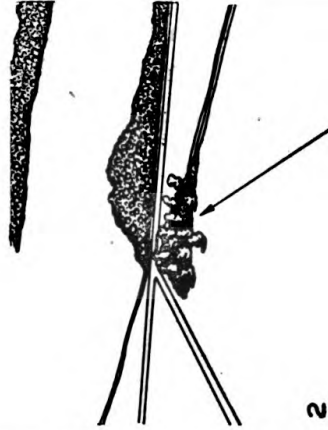
f. Example 6.—(1) Mission.—The observer, assigned to a battalion of 105-mm howitzers, has the mission of locating targets and adjusting fire upon them.

(2) Prearrangement.—The observer does not check in with any higher headquarters; he reports directly to the battalion. Photographs and maps are not available; the general locations of the target and position areas are known from a previous reconnaissance flight. The position area is to be verified by panels. For establishment of scale and orientation and identification of base point, a smoke ladder is to be used.

Radiotelegraph communication	Radiotelephone communication, sensings, and commands	Results	Remarks
<p>Obsr to Bn: BT MK BP LA SM K Bn to Obsr: R</p>	<p>Obsr to Bn: MARK BASE POINT. LADDER, SMOKE.</p> <p>Bn to Btry A: NO 1 ADJ, SH SMOKE, CH 4, FQ, BDL 5, LADDER Q 340, 310, 280.</p>		<p>Data are calculated to place the center round of the ladder on the base point.</p>
<p>Bn to Obsr: BT 2-sec. dash K Obsr to Bn: R</p> <p>Obsr to Bn: BT BP 800 LL, 200 SS JA AD K Bn to Obsr: R</p>	<p>Bn to Obsr: BATTERY FIRED.</p> <p>Obsr to Bn: BASE POINT IS 800 LEFT, 200 SHORT, IN- FANTRY ASSEMBLING, WILL ADJUST.</p>		<p>The observer considers the house the base point and then designates the target.</p>

Radiotelegraph communication	Radiotelephone communication, sensings, and commands	Results	Remarks
<p>Bn to Obsr: BT CN 38 BN A K Obsr to Bn: R</p> <p>Bn to Obsr: BT 2-sec. dash K Obsr to Bn: R</p> <p>Obsr to Bn: BT 100 RR, 200 OO K Bn to Obsr: R</p>	<p>Bn to Obsr: CONCENTRATION 38, BATTALION WILL FIRE, A. Bn to Btry A: B ADJ, SH HE, CH 4, FQ, BDR 190, ON NO 1 OP 3, SITE 300, BR, EL 330. Bn to Obsr: BATTERY FIRED.</p> <p>Obsr to Bn: 100 RIGHT, 200 OVER.</p>	 <p>2</p>	<p>HCO plots this point and gives the range and map shift to each computer. Fire commands which include DO NOT LOAD are sent at the same time to Batteries B and C. The observer senses with respect to the gun-target line.</p>
<p>Bn to Obsr: BT 2-sec. dash K Obsr to Bn: R</p> <p>Obsr to Bn: BT 50 LL 50 SS FE K Bn to Obsr: R</p>	<p>Bn to Btry A: LEFT 25, 310. Bn to Obsr: BATTERY FIRED.</p> <p>Obsr to Bn: 50 LEFT, 50 SHORT, FIRE FOR EFFECT.</p>	 <p>2</p>	<p>100/4.0=25 mils. 330-20 (c is 10)=310.</p>

50/4=13 mils.
 310+5 ($\frac{1}{2}c$)=315.
 The corrections obtained from adjustment of Battery A are applied to the initial commands sent to Batteries B and C.
 The observer notes the fire of the battalion as a whole.



Bn to Btry A:
 R 13, SIX RDS, 315.
 Bn to Btries B and C:
 The commands to correct deflection (left 12) and elevation (minus 15 mils).
 Bn to Obsr:
 BATTERY A FIRING FOR EFFECT.
 BATTERY B FIRING FOR EFFECT.
 BATTERY C FIRING FOR EFFECT.
 * * *
 FIRE FOR EFFECT COMPLETED.

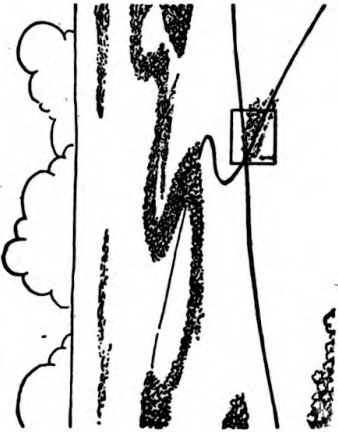
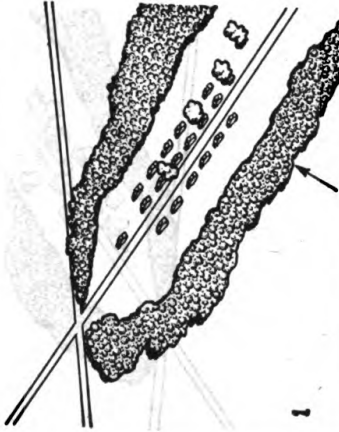
Bn to Obsr:
 BT BA A FE
 BA B FE
 BA C FE
 * * *

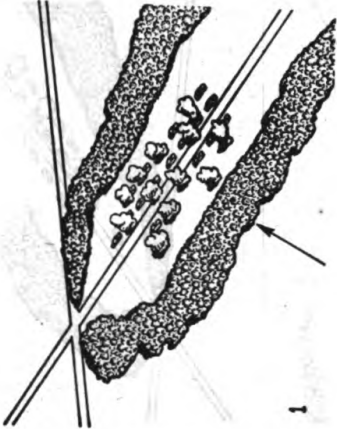
FC K

Obsr to Bn:
 BT RA FE K
 Bn to Obsr:
 FE K
 (or NO VA)
 (or: Obsr to Bn:
 BT RZ K
 Bn to Obsr:
 R VA)

g. Example 7.—(1) Mission.—The observer assigned to the division artillery has the mission of locating targets and adjusting fire upon them, particularly those defiladed from forward observers.

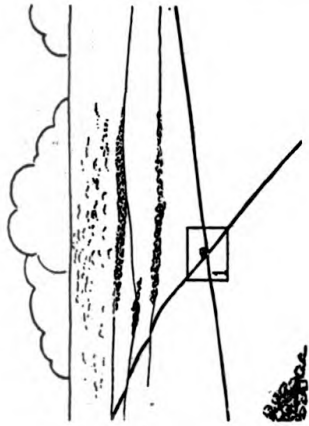
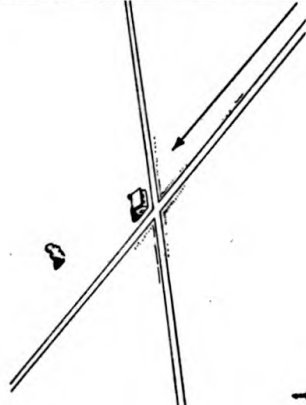
(2) Prearrangement.—The observer is to report directly to the division artillery commander. He does not check in with any battalion; all are to listen in on the same frequency and tune their stations while listening to the check-in. The observer is furnished a gridded photograph. This photograph covers the division front, but it has not yet been sufficiently controlled by ground survey to permit surveillance of accurate initial fires. The observer knows the call sign and position area of each battalion. He understands that any one of them may be selected for the adjustment and that more than one of them may fire for effect.

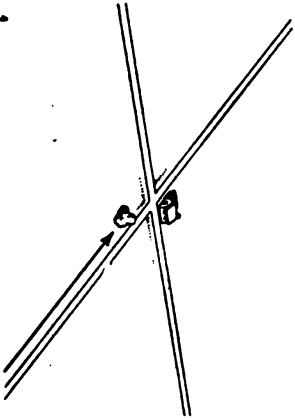
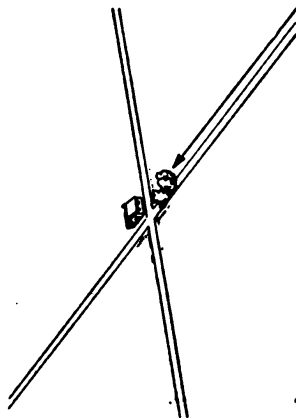
Radiotelegraph communication	Radiotelephone communication, sensings, and command	Results	Remarks
<p>Obsr to Div Arty: BT CD HM 47 JT AD AT K</p> <p>Div Arty to Obsr: R BT AU3 VA</p> <p>Bn to Obsr: BT CN 48 BN B BY K</p>	<p>Obsr to Div Arty: HM 47, TANKS ASSEMBLED. WILL ADJUST. AT MY COMMAND.</p> <p>Bn to Obsr: CONCENTRATION 48. BATTALION WILL FIRE. B, 5 VOLLEYS. BATTERY IS READY.</p>		<p>"At my command" is necessary because moving cloud formations make observation intermittent.</p> <p>Div Arty acknowledges the message, and assigns the mission to battalion AU3.</p>
<p>Obsr to Bn: IX 5-sec. dash K</p> <p>Bn to Obsr: BT 2-sec. dash K</p> <p>Obsr to Bn: BT 50 RR CR FE K</p> <p>Bn to Obsr: R</p>	<p>Obsr to Bn: FIRE.</p> <p>Bn to Obsr: BATTERY FIRED.</p> <p>Obsr to Bn: 50 RIGHT, RANGE CORRECT. FIRE FOR EFFECT.</p>		

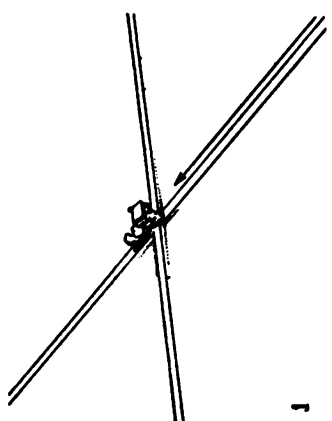
Radiotelegraph communication	Radiotelephone communication, sensings, and commands	Results	Remarks
<p>Bn to Obsr: BT 2-sec. dash K</p> <p>Obsr to Bn: BT CR RA FE GO K</p> <p>Bn to Obsr: R BT FE VA</p>	<p>Bn to Btries: (The deflection change to place the fire of all batteries on the target, and the commands to fire for effect.)</p> <p>Bn to Obsr: BATTALION FIRED.</p> <p>Obsr to Bn: RANGE CORRECT. REPEAT FIRE FOR EFFECT. GOING HOME, FORCED TO LAND.</p>		<p>The battalion fires at the command of the observer until he gives the command FIRE FOR EFFECT.</p> <p>Each battery of the battalion fires five volleys. The observer senses the mass of fire as a whole, and calls for additional fire before going home.</p>

h. Example 8.—(1) Mission.—The observer, assigned to a 155-mm gun battalion, has the mission of conducting a precision adjustment on a crossroad for the purpose of later interdiction and as a registration for transfers in the vicinity.

(2) Prearrangement.—The observer is shown, on air photographs, the locations of the battalion position area and the crossroad. He is to check in directly with the battalion; no intermediate check-in with a higher headquarters is necessary. He is told that the initial round will be fired with metro data.

Radiotelegraph communication	Radiotelephone communication, sensings, and commands	Results	Remarks
<p>Obsr to Bn: BT IX 5-sec. dash K</p>	<p>Obsr to Bn: FIRE. Bn to Btry B: NO 1 ADJ, SH HE, SCH, FQ, BDR 120, NO 1 ONE RD, Q 270.</p>		<p>Observer checks communication with the battalion while he locates the crossroad. When he has identified the target he sends the command FIRE, as prearranged.</p> <p>When practicable the commands may be sent to the battery in advance.</p>
<p>Bn to Obsr: BT 2-sec. dash K Obsr to Bn: BT 50 RR 200 OO K Bn to Obsr R</p>	<p>Bn to Obsr: BATTERY FIRED. Obsr to Bn: 50 RIGHT, 200 OVER.</p>		

<p>Bn to Obsr: BT 2-sec. dash K Obsr to Bn: BT 10 LL 50 SS K Bn to Obsr: R</p>	<p>Bn to Btry B: LEFT 4, 262. Bn to Obsr: BATTERY FIRED. Obsr to Bn: 10 LEFT, 50 SHORT.</p>		<p>50/12.3=4 mils. (R=12.3) 270-8 (c is 4)=262.</p>
<p>Bn to Obsr: BT BQ 2-sec. dash K Obsr to Bn: BT SS SS SS K Bn to Obsr: R</p>	<p>Bn to Btry B: RIGHT 1, THREE RDS. 264. Bn to Obsr: WILL FIRE THREE ROUNDS. BATTERY FIRED. Obsr to Bn: SHORT, SHORT, SHORT.</p>		<p>10/12.3=1 mil. 262+2 (1/2c)=264. Battalion commander decides the adjustment is accurate enough to start fire for effect.</p>

Radiotelegraph communication	Radiotelephone communication, sensings, and command	Results	Remarks
<p>Bn to Obsr: 2-sec. dash K</p> <p>Obsr to Bn: <u>BT</u> OO SS OO K</p> <p>Bn to Obsr: <u>BT</u> GO <u>VA</u></p> <p>Obsr to Bn: R <u>VA</u></p>	<p>Bn to Btry B: 268.</p> <p>Bn to Obsr: BATTERY FIRED.</p> <p>Obsr to Bn: OVER, SHORT, OVER.</p> <p>Bn to Obsr: NO FURTHER NEED OF YOU, GO HOME.</p>		<p>Increases elevation one-half fork ($F=7$, $\frac{1}{2} F=3$ or 4).</p> <p>4 shorts, 2 overs.</p> <p>$266 + (2/12 \times 7) = 267.2$.</p> <p>Adjusted elevation 267.</p>

APPENDIX

FIRE-CONTROL CODE

1. Encoding section.

<i>Code group</i>	<i>Meaning</i>
A F	Additional fire; request additional fire; you will receive additional fire.
A P	Aiming point.
J M	Ammunition dump.
A A	Antiaircraft guns.
J I	Antitank guns.
A T	At my command.
B D	Base deflection.
B P	Base point (is).
B N	Battalion; request battalion; battalion will fire.
B A	Battery
J N	Battery in position.
B Y	Battery ready; is battery ready?
B K	Bracket adjustment.
B G	Brigade; request brigade; brigade will fire.
B C	By piece.
J F	Cavalry.
C F	Cease firing; have ceased firing.
C I	Center of impact.
C T	Change target.
C G	Charge (numerals).
C K	Checking communications.
C L	Close (numerals).
C P	Command post.
C A	Compass.
C N	Concentration No. (numerals).
C V	Converge at (numerals).
C D	Coordinates.
K R	Corrector.
J P	Counterattack.
J Q	Crossroads.
D F	Deflection.
D V	Division; request division; division will fire.
D N	Down (numerals).
E L	Elevation.
E N	Enemy (located at) -----:
E R	Erratic.
F H	Fire concentration No. (numerals).
R Z	Fire effective; mission accomplished.
F C	Fire for effect completed.
F S	Fire for effect suspended.
F E	Fire for effect; will fire for effect.

<i>Code group</i>	<i>Meaning</i>
B Q	Fire (will fire) series of three (3) rounds.
F P	First (No. 1).
F I	Follow instructions (No. -----).
L P	Fourth (No. 4).
F D	Fuze delay.
F Q	Fuze quick.
F R	Fuze range.
G O	Go (going) home; forced to land.
G P	Groupment; request groupment; groupment will fire.
H A	Has battery fired; battery fired.
I D	Identification group, display(ing)(ed).
J A	Infantry assembled (assembling).
J H	Infantry howitzers.
J C	Infantry in column.
J B	Infantry in open.
L A	Ladder.
L M	Lay on me; will lay on you.
L L	Left.
L S	Less.
L F	Lift (to) (from) (at) (No.):
L T	Lost.
J J	Machine guns.
M P	Map; photomap; photograph (No. -----).
M K	Mark (identify by fire).
J V	Mechanized vehicles.
M M	More.
J D	Mortar.
M O	Move; moving.
A W	My altitude is ----- feet; what is your altitude?
N F	No further need of you; movement completed; go to next assignment.
N O	No; will not fire.
N C	Normal charge.
O I	Observation impossible.
J O	Observation post.
O P	Open.
O O	Over.
P K	Percussion.
P A	Precision adjustment.
R N	Range.
C R	Range correct.
O B	Ready to observe; request observation.
R C	Reduced charge.
R P	Reference point.
R G	Regiment; request regiment; regiment will fire.
R A	Repeat range.
R Q	Request relief.
R R	Right.
R J	Road junction.
R S	(Numerals) Rounds.
S P	Second (No. 2).

<i>Code group</i>	<i>Meaning</i>
S N	Sheaf too narrow.
S W	Sheaf too wide.
S H	Shell.
S S	Short.
S I	Site.
S M	Smoke shell.
S C	Supercharge.
S V	Surveillance.
S E	Sweeping.
J T	Tanks.
T A	Target.
T P	Third (No. 3).
T I	Time.
J U	Trucks.
U P	Up (numerals).
V J	Verify the adjustment.
A D	Will adjust; request adjustment on target just reported.
Z L	Zone (limiting ranges).
J W	-----
J X	-----
J Y	-----

2. Decoding section.

A A	Antiaircraft guns.
A D	Will adjust; request adjustment on target just reported.
A F	Additional fire; request additional fire; you will receive additional fire.
A P	Aiming point.
A T	At my command.
A W	My altitude is ----- feet; what is your altitude?
B A	Battery.
B C	By piece.
B D	Base deflection.
B G	Brigade; request brigade; brigade will fire.
B K	Bracket adjustment.
B N	Battalion; request battalion; battalion will fire.
B P	Base point (is).
B Q	Fire (will fire) series of three (3) rounds.
B Y	Battery ready; is battery ready?
C A	Compass.
C D	Coordinates.
C F	Cease firing; have ceased firing.
C G	Charge (numerals).
C I	Center of impact.
C K	Checking communications.
C L	Close (numerals).
C N	Concentration No. (numerals).
C P	Command post.
C R	Range correct.
C T	Change target.

<i>Code group</i>	<i>Meaning</i>
C V	Converge at (numerals).
D F	Deflection.
D N	Down (numerals).
D V	Division; request division; division will fire.
E L	Elevation.
E N	Enemy (located at) -----.
E R	Erratic.
F C	Fire for effect completed.
F D	Fuze delay.
F E	Fire for effect; will fire for effect.
F H	Fire concentration No. (numerals):
F I	Follow instructions (No. -----).
F P	First (No. 1).
F Q	Fuze quick.
F R	Fuze range.
F S	Fire for effect suspended.
G O	Go (going) home; forced to land.
G P	Groupment; request groupment; groupment will fire.
H A	Has battery fired; battery fired.
I D	Identification group, display(ing) (ed).
J A	Infantry assembled (assembling).
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J I	Antitank guns.
J J	Machine guns.
J M	Ammunition dump.
J N	Battery in position.
J O	Observation post.
J P	Counterattack.
J Q	Crossroads.
J T	Tanks.
J U	Trucks.
J V	Mechanized vehicles.
J W	-----
J X	-----
J Y	-----
K R	Corrector.
L A	Ladder.
L F	Lift (to) (from) (at) (No.).
L L	Left.
L M	Lay on me; will lay on you.
L P	Fourth (No. 4).
L S	Less.
L T	Lost.
M K	Mark (identify by fire).
M M	More.
M O	Move; moving.

<i>Code group</i>	<i>Meaning</i>
MP	Map; photomap; photograph (No. -----).
NC	Normal charge.
NF	No further need of you; movement completed; go to next assignment.
NO	No; will not fire.
OB	Ready to observe; request observation.
OI	Observation impossible.
OO	Over.
OP	Open.
PA	Precision adjustment.
PK	Percussion.
RA	Repeat range.
RC	Reduced charge.
RG	Regiment; request regiment; regiment will fire.
RJ	Road junction.
RN	Range.
RP	Reference point.
RQ	Request relief.
RR	Right.
RS	(Numerals) rounds.
RZ	Fire effective; mission accomplished.
SC	Supercharge.
SE	Sweeping.
SH	Shell.
SI	Site.
SM	Smoke shell.
SN	Sheaf too narrow.
SP	Second (No. 2).
SS	Short.
SV	Surveillance.
SW	Sheaf too wide.
TA	Target.
TI	Time.
TP	Third (No. 3).
UP	Up (numerals).
VJ	Verify the adjustment.
ZL	Zone (limiting ranges).

[A. G. 062.11 (1-13-42).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

DISTRIBUTION:

B 4, 6 (3); R 6 (10), 7 (5); R and H 1 (6); IBn 1 (10); Bn
and L 6 (4), 11 (1).

(For explanation of symbols see FM 21-6.)

